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1 INTRODUCTION

The purpose of this document is to describe the packet structure of all Telecommand Packets to control the HIFI on-board software.

2 DOCUMENT REFERENCES

2.1 Applicable Documents

AD 1. Packet Structure ICD SCI-PT-ICD-7527 issue 2.0 draft 2

2.2 Reference Documents

RD 1. Test-equipment interface URD SRON-U/HIFI/SP/2001-009

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3 HEADER DEFINITION

This section describes the packet headers. The position indicates the position of the field expressed in bytes with respect to the start of the source packet header.

3.1 TC source packet

Table: 3.1-1 TC packet format

Source packet header						Packet data field			
Packet ID				seq control		length	Data Field header	Source data	PEC
version	Type	flag	APID	segm	count				
3	1	1	11	2	14				
16 bits				16 bits		16 bits	32 bits	N*16 bits	16 bits

Table: 3.1-2 source packet header

Position	Field	Length	value	
0,1	Version	3 bit	000	
	Type	1 bit	1	
	Header flag	1 bit	1	
	APID	11 bit		
2,3	Sequence flags	2 bit	11	
	Sequence counter	source	3 bit	000
		count	11 bit	
4,5	packet length	16 bit		

- APID is specified in the following sections
- Three bits of the sequence count bit indicate the source. In this case the source is always 000
- The 11 bits-field of the sequence counter represent the actual counter. This field shall be maintained by each source for each APID. Wraps from full scale to 0.
- The packet length indicates the number of octets in the packet data field, minus 1.

Table: 3.1-3 Data header field

Position	Field	Length	value
6	CCSDS secondary header flag	1 bit	0
	PUS version	3 bit	0
	ACK	4 bit	
7	Packet type:	8 bit	
8	Packet subtype:	8 bit	
9	Spare	8 bit	0

Table: 3.1-4 Description ACK field

Bit	Description
bit 3	Acknowledge acceptance
bit 2	Acknowledge start of execution
bit 1	Acknowledge progress
bit 0	Acknowledge completion

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3.2 TM source packet:

Source packet header						Packet data field			
Packet ID				seq control		length	Data Field header	Source data	PEC
version	Type	flag	APID	segm	count				
3	1	1	11	2	14				
16 bits				16 bits		16 bits	80 bits	N*16 bits	16 bits

Table: 3.2-1 Source packet header

Position	Field	Length	value
0,1	Version	3 bit	0
	Type	1 bit	0
	Header flag	1 bit	1
	APID	11 bit	
2,3	Segmentation flag	2 bit	
	Source sequence counter	14 bit	
4,5	packet length	16 bit	

- The packet length C indicates the number of octets in the packet data field, minus 1. C is always an odd number

Table: 3.2-2 Data header field

Position	Field	Length	value
6	Spare	1 bit	0
	PUS version	3 bit	0
	Spare	4 bit	0
7	Packet type:	8 bit	
8	Packet subtype:	8 bit	
9	Spare	8 bit	0
10-13	Course On-board Time [s]	32 bit	
14,15	Fine on-board time [sub-seconds]	16 bit	

- Packet type and subtype are specified in the next sections

4 TM-TC DEFINITION

4.1 All TEI

4.1.1 Telecommands accepted by all TEI's

Set OBS-ID

Identifier	value
APID	2016-2023
Type	8
Subtype	4

Application data:

pos		Field	length	value
10		Function ID	8	1
11		Activity ID	8	1
12	13	Structure ID	16	
14	17	spare	32	0
18	21	OBS ID	32	

Set BB-ID

Application data:

pos		Field	length	value
10		Function ID	8	1
11		Activity ID	8	2
12	13	Structure ID	16	
14	17	BB ID	32	

Perform connection test

Identifier	value
APID	2016-2023
Type	17
Subtype	1

No Application data

4.1.2 Telemetry generated by all TEI's

Telecommand acceptance report - success

Identifier	value
APID	2016-2023
Type	1
Subtype	1

Table 1 Successful acceptance report

Pos		Field	length	value
16	17	TC packet ID	16	



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Pos	Field	length	value
18	19	Packet sequence control	16

Telecommand acceptance report- failure

Identifier	value
APID	2016-2023
Type	1
Subtype	2

Table 2 Unsuccessful acceptance report

Pos	Field	length	value
16	17	TC packet ID	16
18	19	Packet sequence control	16
20	21	Code	8
		Parameter	8

Table 3 Unsuccessful acceptance error code

Code	Description
0	Illegal APID
1	Incomplete or illegal length packet
2	Incorrect checksum
3	Illegal packet type
4	Illegal packet subtype
5	Illegal or inconsistent application data.
17-255	TBD

Error/alarm

Identifier	value
APID	2016-2023
Type	5
Subtype	4

Table 4 error alarm report

Pos	Field	length	value
16	17	Event ID	16
18	19	Structure ID	16
20	21	Any Parameter	

The parameter field must be specified for each (APID,Event-ID) combination.

Link connection report

Identifier	value
APID	2016-2023
Type	17
Subtype	2

4.2 TEI-PDU

4.2.1 Telecommands to TEI-PDU

The following telecommands are implementations of perform an activity of a function.

Identifier	value
APID	2016
Type	8
Subtype	4

Switch on

pos		Field	length	value
10		Function ID	8	2
11		Activity ID	8	1
12	13	Structure ID	16	
14	17	BB ID	32	
18	19	PD switch	16	

Switch off

pos		Field	length	value
10		Function ID	8	2
11		Activity ID	8	2
12	13	Structure ID	16	
14	17	BB ID	32	
18	19	PD switch	16	

Set resistor values

pos		Field	length	value
10		Function ID	8	2
11		Activity ID	8	3
12	13	Structure ID	16	
14	17	BB ID	32	
18	19	PD Sense R1	16	
20	21	PD Sense R2	16	
22	23	PD Sense R3	16	
24	25	PD Sense R4	16	
26	27	PD Sense R5	16	
28	29	PD Sense R6	16	
30	31	PD Sense R7	16	
32	33	PD Sense R8	16	
34	35	PD Sense R9	16	
36	37	PD Sense R10	16	

4.2.2 Telemetry interface

House keeping report

Identifier	value
APID	2016



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Type	3
Subtype	25

Position	Field	length	value
16	17	SID	16
18	21	Observation ID	32
22	25	Building Block ID	32
26	27	PD sw cmd status	16
28	29	PD sw fault stat	16
30	31	PD volt in1	16
32	33	PD volt in2	16
34	35	PD volt out1	16
36	37	PD volt out2	16
38	39	PD volt out3	16
40	41	PD volt out4	16
42	43	PD volt out5	16
44	45	PD volt out6	16
46	47	PD volt out7	16
48	49	PD volt out8	16
50	51	PD volt out9	16
52	53	PD volt out10	16
54	55	PD curr out1	16
56	57	PD curr out2	16
58	59	PD curr out3	16
60	61	PD curr out4	16
62	63	PD curr out5	16
64	65	PD curr out6	16
66	67	PD curr out7	16
68	69	PD curr out8	16
70	71	PD curr out9	16
72	73	PD curr out10	16
74	75	PD curr sens1	16
76	77	PD curr sens2	16
78	79	PD curr sens3	16
80	81	PD curr sens4	16
82	83	PD curr sens5	16
84	85	PD curr sens6	16
86	87	PD curr sens7	16
88	89	PD curr sens8	16
90	91	PD curr sens9	16
92	93	PD curr sens10	16

switch event report

Identifier	value
APID	2016
Type	5
Subtype	1



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Position		Field	length	value
16	17	SID	16	
18	21	Observation ID	32	
22	25	Building Block ID	32	
26	27	PD sw cmd status	16	

Error report

Identifier	value
APID	2016
Type	5
Subtype	4

Position		Field	length	value
16	17	SID	16	
18	21	Observation ID	32	
22	25	Building Block ID	32	
26	27	PD sw fault stat	16	

4.3 TEI-FPU

4.3.1 Telecommands to TEI-FPU

The following telecommands are implementations of perform an activity of a function.

Identifier	value
APID	2017
Type	8
Subtype	4

Set status TC1

Command mnemonic: FPU_set_TC1_status

position	Field	length	value
10	Function ID	8	2
11	Activity ID	8	1
12	13	Structure ID	16
14	17	BB ID	32
18	19	FPU TC1 status	16

Status=0: stand-by

Status=1: active

Set Temp TC1

Command mnemonic: FPU_set_TC1_temperature

position	Field	length	value
10	Function ID	8	2
11	Activity ID	8	2
12	13	Structure ID	16
14	17	BB ID	32
18	19	FPU TC1 set	16

Set status TC2

Command mnemonic: FPU_set_TC2_status

position	Field	length	value
10	Function ID	8	3
11	Activity ID	8	1
12	13	Structure ID	16
14	17	BB ID	32
18	19	FPU TC2 status	16

Status=0: stand-by

Status=1: active

Set Temp TC2

Command mnemonic: FPU_set_TC2_temperature

position		Field	length	value
10		Function ID	8	3
11		Activity ID	8	2
12	13	Structure ID	16	
14	17	BB ID	32	
18	19	FPU TC2 set	16	

Control shutter

Command mnemonic: FPU_set_shutter_status

position		Field	length	value
10		Function ID	8	4
11		Activity ID	8	1
12	13	Structure ID	16	
14	17	BB ID	32	
18	19	FPU shutter	16	

Status=1: open

Status=2: close

Status=3: wobble

4.3.2 Telemetry interface

Error Alarm report

Identifier	value
APID	2017
Type	5
Subtype	1

Position	Field	length	value
16	17	SID	16
18	21	Observation ID	32
22	25	Building Block ID	32
26		FPU compressor	8
27		spare	8

House Keeping

Identifier	value
APID	2017
Type	3
Subtype	25

Position	Field	length	value
16	17	SID	16
18	21	Observation ID	32
22	25	Building Block ID	32
26	27	FPU Equipment status	16
28		FPU TC1 status	8



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Position	Field	length	value
29	FPU TC2 status	8	
30	31 FPU TC1 set	16	
32	33 FPU TC2 set	16	
34	35 FPU TC1	16	
36	37 FPU TC2	16	
38	39 FPU LS1 sensor 1	16	
40	41 FPU LS1 sensor 2	16	
42	43 FPU LS1 sensor 3	16	
44	45 FPU LS1 sensor 4	16	
46	47 FPU LS1 sensor 5	16	
48	49 FPU LS1 sensor 6	16	
50	51 FPU LS1 sensor 7	16	
52	53 FPU LS1 sensor 8	16	
54	55 FPU LS2 sensor 1	16	
56	57 FPU LS2 sensor 2	16	
58	59 FPU LS2 sensor 3	16	
60	61 FPU LS2 sensor 4	16	
62	63 FPU LS2 sensor 5	16	
64	65 FPU LS2 sensor 6	16	
66	67 FPU LS2 sensor 7	16	
68	69 FPU LS2 sensor 8	16	
70	71 FPU He level	16	
72	73 FPU He pressure	16	
74	75 FPU Hot/cold temp 1	16	
76	77 FPU Hot/cold temp 2	16	
78	79 FPU Heat switch1	16	
80	81 FPU Heat switch2	16	
82	FPU shutter status	8	
83	FPU compressor status	8	
84	85 FPU gas flow 1	16	
86	87 FPU gas flow 2	16	

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4.4 TEI LOU

To be done

4.5 TEI-scanner

4.5.1 Telecommands to TEI-scanner

The following telecommands are implementations of perform an activity of a function.

Identifier	value
APID	2019
Type	8
Subtype	4

SCN set position

position	Field	length	value
10	Function ID	8	2
11	Activity ID	8	1
12	13	Structure ID	16
14	17	BB ID	32
18	19	SCN x2	16
20	21	SCN y2	16
22	23	SCN delta t	16

4.5.1.1 Telemetry from TEI-scanner

Scanner measurements report

Identifier	value
APID	2019
Type	21
Subtype	1

Position	Field	length	value
16,17	SID	16	
18,21	Observation ID	32	
22,25	Building Block ID	32	
26,31	SCN T1	48	
32,33	SCN Cal status	16	
34,35	SCN x1, SCN y1		
	etc for all points.		

Maximum number of points: ...

4.6 TEI-SRC

4.6.1 Telecommands to TEI-SRC

The following telecommands are implementations of perform an activity of a function.

Identifier	value
APID	2020
Type	8
Subtype	4

Set Paveliev source: frequency

position		Field	length	value
10		Function ID	8	2
11		Activity ID	8	1
12	13	Structure ID	16	
14	17	BB ID	32	
18	19	SRC Pav Freq	16	

Set Paveliev source: Power

position		Field	length	value
10		Function ID	8	2
11		Activity ID	8	2
12	13	Structure ID	16	
14	17	BB ID	32	
18	19	SRC Pav power	16	

Set Paveliev source: Bias

position		Field	length	value
10		Function ID	8	2
11		Activity ID	8	3
12	13	Structure ID	16	
14	17	BB ID	32	
18	19	SRC Pav bias	16	

Set JPL source: set current

position		Field	length	value
10		Function ID	8	3
11		Activity ID	8	1
12	13	Structure ID	16	
14	17	BB ID	32	
18	19	SRC JPL current	16	

Set JPL source: Bias voltages

pos		Field	length	value
10		Function ID	8	3
11		Activity ID	8	2
12	13	Structure ID	16	
14	17	BB ID	32	
18	19	SRC JPL bias1	16	
20	21	SRC JPL bias2	16	
22	23	SRC JPL bias3	16	
24	25	SRC delta t	16	

Set JPL source: Increase bias values

pos		Field	length	value
10		Function ID	8	3
11		Activity ID	8	3



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pos		Field	length	value
12	13	Structure ID	16	
14	17	BB ID	32	
18		SRC JPL flag1	8	
19		SRC JPL flag2	8	
20		SRC JPL flag3	8	
21		SRC JPL flag4	8	

The parameters bias1- bias 4 may assume value 0 or 1.

0: do not decrease

1: decrease with minimum step size.

Set JPL source: Decrease bias values

position		Field	length	value
10		Function ID	8	3
11		Activity ID	8	4
12	13	Structure ID	16	
14	17	BB ID	32	
18		SRC JPL flag1	8	
19		SRC JPL flag2	8	
20		SRC JPL flag3	8	
21		SRC JPL flag4	8	

The parameters bias1- bias 4 may assume value 0 or 1.

0: do not decrease

1: decrease with minimum step size.

Set Chopper

position		Field	length	value
10		Function ID	8	4
11		Activity ID	8	1
12	13	Structure ID	16	
14	17	BB ID	32	
18	19	SRC chopper	16	

4.6.1.1 Telemetry from TEI-SRC

House keeping report

Identifier	value
APID	2020
Type	3
Subtype	25

Position		Field	length	value
16	17	SID	16	
18	21	Observation ID	32	
22	25	Building Block ID	32	
26	27	SRC Configuration	16	
28	29	SRC startup flag	16	



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Position	Field	length	value
30	31	SRC Gunn voltage	16
32	33	SRC Gunn current	16
34	35	SRC Gunn power	16
36	37	SRC Pav frequency	16
38	39	SRC Pav bias	16
40	41	SRC Pav current	16
42	43	SRC JPL bias1	16
44	45	SRC JPL bias 2	16
46	47	SRC JPL bias 3	16
48	49	SRC JPL current	16
50	51	SRC Pav frequency set	16
52	53	SRC Pav bias set	16
54	55	SRC Pav current set	16
56	57	SRC JPL bias1 set	16
58	59	SRC JPL bias 2 set	16
60	61	SRC JPL bias 3 set	16
62	63	SRC JPL current set	16

House keeping report

Identifier	value
APID	2020
Type	3
Subtype	25

Position	Field	length	value
16	17	SID	16
18	21	Observation ID	32
22	25	Building Block ID	32
26	27	SRC Safety	16

Source Status contains the following 1-bit parameters:

bit #	parameter	meaning
3	status	1: status is undefined, SCOS must not release command to increase any bias
4	bias 1	0: do not increase bias 1 1: safe to increase
5	bias 2	0: do not increase bias 2 1: safe to increase
6	bias 3	0: do not increase bias 3 1: safe to increase
7	bias 4	0: do not increase bias 4 1: safe to increase

Manual settings report

Identifier	value
APID	2020
Type	3
Subtype	25



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Position		Field	length	value
16	17	SID	16	
18	21	Observation ID	32	
22	25	Building Block ID	32	
26	27	SRC Manual Par1	16	
28	29	SRC Manual Par2	16	
30	31	SRC Manual Par3	16	
32	33	SRC Manual Par4	16	
34	35	SRC Manual Par5	16	
36	37	SRC Manual Par6	16	
38	39	SRC Manual Par7	16	
40	41	SRC Manual Par8	16	
42	43	SRC Manual Par9	16	
44	45	SRC Manual Par10	16	

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4.7 TEI-VNA

4.7.1 Telecommands to TEI-VNA

The following telecommands are implementations of perform an activity of a function.

Identifier	value
APID	2021
Type	8
Subtype	4

Get VNA status

pos		Field	length	value
10		Function ID	8	2
11		Activity ID	8	1
12	15	BB ID	32	

Measure data points

pos		Field	length	value
10		Function ID	8	2
11		Activity ID	8	2
12	15	BB ID	32	
16	17	Structure ID	16	
18	19	VNA N points	16	
20	21	VNA delta t	16	

4.7.1.1 Telemetry from TEI-VNA

VNA status report

Identifier	value
APID	2021
Type	3
Subtype	25

Position		Field	length	value
16	17	SID	16	
18	21	Observation ID	32	
22	25	Building Block ID	32	
26	27	VNA configuration	16	

VNA measurements report

Identifier	value
APID	2021
Type	21
Subtype	1

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Position	Field	length	value
16,17	SID	16	
18,21	Observation ID	32	
22,25	Building Block ID	32	
26,31	VNA T1		
32,33	Calibration status		
34,35	VNA P1, VNA A1		
	etc for all points.		

Maximum number of points: ...